

WHAT IS CLAIMED IS:

- 1        1. A device for detecting three-dimensional shapes of an
- 2        elongated flexible body, comprising:
  - 3            a sensor cable adapted to be inserted into an axial coextensive
  - 4            passage within an elongated flexible body, said sensor cable having
  - 5            two pairs of fiber Bragg grating strands each having a plural number of
  - 6            refractive index change portions periodically in a predetermined pitch;
  - 7            a light source connectible to each one of said fiber Bragg grating
  - 8            strands to input a light beam containing a Bragg wavelength to said
  - 9            refractive index change portions; and
  - 10          a signal processor adapted to receive reflection diffraction light
  - 11          signals from said refractive index change portions of each fiber Bragg
  - 12          grating strand, and to detect a three-dimensional shape of said
  - 13          elongated flexible body by measuring degree of straining at each one
  - 14          of said refractive index change portions by way of comparison of said
  - 15          reflection diffraction light signals with a reference wavelength.
- 1        2. A device for detecting three-dimensional shapes as defined in
- 2        claim 1, wherein said pairs of fiber Bragg grating strands are

3        accommodated in a round tubular carrier casing and located on two  
4        perpendicularly intersecting axes and at positions on or close to inner  
5        periphery of said round tubular casing.

1            3. A device for detecting three-dimensional shapes as defined in  
2        claim 2, wherein said refractive index change portions in each one of  
3        said fiber Bragg grating strands are formed substantially at same  
4        positions in axial direction.

1            4. A device for detecting three-dimensional shapes as defined in  
2        claim 2, wherein said sensor cable is adapted to be placed in a biopsy  
3        channel extending through an insertion tube of an endoscope.

1            5. A device for detecting three-dimensional shapes as defined in  
2        claim 1, wherein said light source is arranged to emit a signal light in  
3        a predetermined wavelength band, and said refractive index change  
4        portions in each one of said fiber Bragg grating strands are adapted to  
5        generate reflection diffraction light signals with respect to different  
6        Bragg wavelengths, and said signal processor is adapted to detect

7 strains in said refractive index change portions on the basis of a shift  
8 of each reflection diffraction light signal from a reference wavelength.

1 6. A device for detecting three-dimensional shapes as defined in  
2 claim 1, wherein said light source is of a low coherence light beam,  
3 said refractive index change portions in each one of said fiber Bragg  
4 grating strands are adapted to generate reflection diffraction light  
5 signals with respect to the same Bragg wavelength, and said signal  
6 processor further includes an interferometer to check for interference  
7 between reflection diffraction light signal from each one of said  
8 refractive index change portions and reference light, detecting strains  
9 in said refractive index change portions on the basis of intensity of  
10 interference light.